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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Serial No:	**10/631,219**	Examiner:	**Tod Thomas Van Roy**
Filing Date:	**28 July 2003**		
Appellant:	**Richard Scheps**	Art Unit:	**2828**

Title: **LASER DIODE PUMPED SOLID-STATE DYE LASER AND METHOD FOR OPERATING SAME**

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23 April 2007

APPELLANT'S APPEAL BRIEF UNDER 37 C.F.R. §41

Sir/Madam:

This is an appeal from a final rejection by Examiner Van Roy of claims 1-11, & 13, which are set forth in a CLAIMS APPENDIX hereto, and which together comprise all remaining claims in the application. Appellant mailed a Notice of Appeal on 1 March, 2007.

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REAL PARTY IN INTEREST

The United States Government, and Richard Scheps are real parties in interest.

RELATED APPEALS AND INTERFERENCES

No related appeals and interferences are known to exist in the present case.

STATUS OF CLAIMS

Claims 1, 3-7, and 9-11 have been finally rejected under 35 U.S.C. 102(b) as being anticipated by US Patent 5530711 to Scheps (hereinafter *'711*). Claims 2 and 8 have been finally rejected under 35 U.S.C 103(a) as being unpatentable over *'711*. Claim 13 is believed to have been finally rejected. However, Appellant is unsure as to the grounds of rejection for claim 13. Claim 12 has been canceled. The rejection of claims 1-11 and 13 is on appeal.

STATUS OF AMENDMENTS

An amendment was filed on 12 December 2006, subsequent to the Final Office Action of 13 November 2006 (hereinafter Final Action). The 12 December 2006 amendment was denied entry by the Examiner.

SUMMARY OF CLAIMED SUBJECT MATTER

Independent claim 1 describes a laser, comprising: a first optically reflective element (Fig 1, page 2, line 21); a second optically reflective element opposed to and aligned with the first optically reflective element to define a laser cavity having an optical axis (Fig 1, page 2, line 21 to page 3, line 1); a laser dye gain element having a laser dye and which is interposed between

the first and second optically reflective elements along the optical axis for transforming an optical pump signal into a resonant optical signal (Fig 1, page 2, line 21 to page 3, line 2); a laser diode system for generating and injecting the optical pump signal into the laser cavity along the optical axis (Fig 1, page 3, lines 2- 11), where the optical pump signal is a sequence of optical pulses (Fig 2, page 3, line 3) having a pulse width of about $n\tau_f$, where τ_f represents a fluorescence lifetime of said laser dye, and $3 \leq n \leq 25$ (page 4, lines 13-15) so that said laser diode system operates in a non-steady-state mode (page 5, line 9).

Independent claim 7 discloses a method for generating a laser output signal, comprising the steps of: operating a diode laser system in non-steady-state mode by generating an optical pump signal that is a sequence of optical pulses each having a pulse width of about $n\tau_f$, where τ_f represents a fluorescence lifetime of a laser dye and $3 \leq n \leq 25$ (page 4, lines 13-15); directing the optical pump signal into an optical resonant cavity (page 3, line 1) having a laser dye gain element that contains the laser dye for transforming the optical pump signal into an excited optical signal (page 3, lines 8-11); resonating the excited optical signal in the optical resonant cavity (page 3, lines 8-11); and emitting a portion of the excited optical signal from the optical resonant cavity (page 4, lines 2-5).

Independent claim 13 discloses a method for generating a laser output signal, comprising the steps of: operating a laser diode system in a non-steady-state mode by generating an optical pump signal that is a sequence of optical pulses each having a pulse width t, wherein $0.950 \leq 1 - e^{-t/\tau_f} \leq 0.993$, and τ_f represents a fluorescence lifetime of a laser dye (Fig. 3, page 4, line 17 to page 5, line 3); directing the optical pump signal into an optical resonant cavity having a laser dye gain element which contains the laser dye that is characterized by the fluorescent lifetime, τ_f (page 4, lines 13-15), for transforming the optical pump signal into an excited

optical signal (page 4, line 1); resonating the excited optical signal in the optical resonant cavity (page 3, lines 8-11); and emitting a portion of said excited optical signal from said optical resonant cavity (page 4, lines 2-5).

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

I. Should the 35 U.S.C. §102(b) rejection of claims 1, 3-7, and 9-11 be withdrawn when the rejection is based on '711, which fails to disclose each and every limitation of the claimed invention?

II. Should the 35 U.S.C. §103(a) rejection of claims 2 and 8 be withdrawn when the cited reference ('711) fails to teach or suggest all of the claim limitations?

ARGUMENT

I. The 35 U.S.C. §102(b) rejection of claims 1, 3-7, and 9-11 should be withdrawn because '711 fails to disclose each and every limitation disclosed in the claims.

The United States Code provides that a person shall be entitled to a patent unless:

> *the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.* 35 U.S.C. §102(b)

Section 2131 of the Manual of Patent Examining Procedure further provides:

> *A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference...The identical invention must be shown in as complete detail as is contained in the ...claim.*

Claims 1, 3-7, & 9-11

Appellant respectfully submits that *'711* does not anticipate the invention as claimed in claim 1 and its dependents because each and every claimed limitation of claim 1 is not found in *'711*. There is no express or inherent description in the cited art of an optical-pump-signal-generating laser diode system having a pulse width of about $n\tau_f$, where τ_f represents a fluorescence lifetime of said laser dye, and $3 \leq n \leq 25$. The Examiner maintains that this limitation is found in the following passage from *'711*:

> *An additional advantage of diode-pumped dye lasers arises from the fact that for excitation pulse lengths greater than several times the fluorescence lifetime, the dye laser produces a steady state emission for most of the duration of the excitation pulse.* (*'711* col. 20, lines 15-19)

The passage cited to by the Examiner merely discloses an open-ended range of pulse widths greater than "several" times τ_f. In other words, *'711* discloses a pulse width of $n\tau_f$, where "several" $\leq n \leq$ infinity. This practically boundless limitation in *'711* falls short of the level of detail required to show anticipation of the range of n from 3 to 25 as described in claim 1. The word "several" is ambiguous at best. Due to the ambiguity of the word "several," it is speculation as to whether the claimed range of $3 \leq n \leq 25$ falls within, overlaps, or even touches the range taught by *'711*.

There is no description in *'711* of a laser-diode pumping source operating in non-steady-state mode. The Examiner has cited column 19, lines 30-49 of *'711* as showing a laser diode pumping source "operated in pulsed mode, which [according to the Examiner] is non-steady-state." (Final Action page 3) While it is true that the cited section refers to a laser-diode

excitation source, which may operate in a pulsed mode or continuous wave mode, pulsed mode is not equivalent to non-steady-state mode as described in claim 1. Appellant has submitted a declaration under 37 C.F.R. 1.132 by the inventor of *'711* that "*pulsed* operation of a diode laser does not equal *non-steady-state* operation of a diode laser." (See Declaration of Richard Scheps Under 37 CFR§ 1.132, appended to the Response to an Office Action dated 5 September 2006) (emphasis added) The non-steady-state operation of the diode laser system of claim 1 is achieved when the diode system has a pulse width of about $n\tau_f$, where τ_f represents a fluorescence lifetime of said laser dye, and $3 \leq n \leq 25$. As shown above, *'711* teaches no such pulse-width range limitation.

Claim 1 also limits the operation of the diode laser pumping source to non-steady-state operation. Nowhere does reference *'711* disclose the limitation that the excitation source must operate in non-steady-state mode. Only for the first few tens of nanoseconds after being turned on is a diode laser considered to be operating in non-steady-state mode. (Specification page 5, line 9; See also Declaration of Richard Scheps Under 37 CFR 1.132, appended to the Response to an Office Action dated 5 September 2006) After the first 50-100 nanoseconds a diode laser operates in a quasi-continuous wave mode. (Specification page 5, line 8; See also Declaration of Richard Scheps Under 37 CFR 1.132, appended to the Response to an Office Action dated 5 September 2006) The Examiner maintains that pulsed operation of a diode laser is equivalent to non-steady-state operation and therefore anticipated by *'711*, which teaches pulsed operation of diode lasers. (Final Action page 3) However, pulsed operation is not equivalent to non-steady-state operation. In contrast to non-defined pulsed operation of a diode laser, which may include pulses of any duration, non-steady-state operation of a diode laser is only achieved for the first few tens of nanoseconds after being turned on. (Specification page 5, line 9; See also Declaration

of Richard Scheps Under 37 CFR 1.132, appended to the Response to an Office Action dated 5 September 2006) Only a small segment of every pulse may be considered non-steady-state. A diode laser with a pulse width over about 100 nanoseconds merely transitions through a non-steady-state segment of each pulse into a quasi-continuous segment and cannot be said to be operating in a non-steady-state mode. The Examiner cites to col. 1, lines 56-59 of US patent 5307358 by Scheps (hereinafter *'358*) to further support the position that "pulsed operation is considered non-steady-state." (Final Action page 4) The section of *'711* cited states, "[G]enerally speaking, lasers...can be excited by either [steady-state] means, or by pulsed means." '358 col. 1, lines 54-56. However, the mere juxtaposition of the terms *pulsed* and *steady-state* does not lead to a conclusion that *pulsed* is equal to *non-steady-state.* As explained above, the term *non-steady-state*, is not equal to the broad term *pulsed*, but is defined in the specification as limited to the pulse-width range of 0 to about 100 nanoseconds. It would therefore be inaccurate to equate a general pulsed mode to the more specific non-steady-state mode.

Examiner further maintains that "[a]s the claim does not state operation **only** in non-steady state mode it is believed that the pulsed mode of Sheps [sic] '711 would inherently operate in a non-steady state mode for a given interval prior to quasi-continuous operation, thereby meeting the claimed limitation." (Final Action page 2) Appellant respectfully submits that the diode laser system of claim 1 inherently operates **only** in non-steady-state mode as it is restricted to operation within the range of $3 \leq n \leq 25$, as described above. Being thus limited, the laser diode system of a necessity operates only in non-steady-state mode. The limitation of a laser diode pumping source operating only in a non-steady-state mode is not found in *'711.*

Claim 13

Appellant believes claim 13 was finally rejected because it is listed as rejected in the Office Action Summary submitted with the Final Action. However, Appellant respectfully submits that no clear grounds for rejection were provided in the body of the Final Action. From the wording of the final paragraph of the section *Claim rejections –35 USC 102* found on page 4 of the Final Action, one may assume that it was the Examiner's intention to reject claim 13 on the same basis as claims 7, and 9-11. Assuming, for the sake of argument, that claim 13 was intended to be rejected on the same grounds as claims 7, and 9-11, Appellant respectfully submits that '711 does not teach every limitation of claim 13. All of the arguments raised regarding claim 1 apply to claim 13. Furthermore, the range limitation described in claim 13 of $0.950 \le 1 - e^{-t/\tau_f} \le 0.993$ is equivalent to a diode laser pulse-width range of $3\tau_f$ - $25\tau_f$, which is narrower than the pulse-width range disclosed in claim 1. As this limitation is not found in *'711*, the rejection to claim 13 should be withdrawn.

II. The 35 U.S.C. 103(a) rejection of claims 2 and 8 should be withdrawn because '711 fails to teach or suggest all of the claim limitations.

> *To establish prima facie obviousness of a claimed invention, **all** the claim limitations must be taught or suggested by the prior art.* (emphasis added) In re Royka, 490 F.2d 981, MPEP 2143.03

Claims 2 & 8

Appellant respectfully contends that the 35 U.S.C. §103(a) rejection of claims 2 and 8 is improper because the Examiner has failed to establish a *prima facie* case of

obviousness. A *prima facie* case of obviousness has not been established because not all the claim limitations are taught or suggested by '711. As dependent claims of claims 1 and 7 respectively, claims 2 and 8 incorporate all the limitations of claims 1 and 7. As discussed above, claims 1 and 7 include the diode laser pulse-width limitation of $3\tau_f$ - $25\tau_f$, which is not found in *'711*. Therefore, the obviousness rejection of claims 2 and 8 should be withdrawn.

CONCLUSION

For the reasons expressed above, the claims on appeal are unobvious and unanticipated. Therefore, the respective rejections should be withdrawn and a notice of allowance issued for the appealed claims. The Commissioner is authorized to charge Deposit Account No. **50-0847** an amount of **$500.00** to pay the fee for filing a brief in support of an appeal per 37 C.F.R. 1.17(c). Please charge any deficit or credit any excess to Deposit Account No. **50-0847**.

Respectfully submitted,

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CLAIMS APPENDIX

Claims Involved in the Appeal

1. A laser, comprising:

a first optically reflective element;

a second optically reflective element opposed to and aligned with said first optically reflective element to define a laser cavity having an optical axis;

a laser dye gain element having a laser dye and which is interposed between said first and second optically reflective elements along said optical axis for transforming an optical pump signal into a resonant optical signal;

a laser diode system for generating and injecting said optical pump signal into said laser cavity along said optical axis, where said optical pump signal is a sequence of optical pulses having a pulse width of about $n\tau_f$, where τ_f represents a fluorescence lifetime of said laser dye, and $3 \leq n \leq 25$ so that said laser diode system operates in a non-steady-state mode.

2. The laser of claim 1 wherein said optical pump signal has a pulse period in the range of about 1 Khz to 1 Mhz.

3. The laser of claim 1 wherein said laser dye gain element includes a host material selected from the group that includes porous glass, plastic, and sol-gels.

4. The laser of claim 3 wherein said plastic consists essentially of modified polymethyl methacrylate.

5. The laser of claim 1 wherein said first optically reflective element has a curved reflective surface.

6. The laser of claim 5 wherein said first and second optically reflective elements define a nearly hemispherical resonator.

7. A method for generating a laser output signal, comprising the steps of:

operating a diode laser system in non-steady-state mode by generating an optical pump signal that is a sequence of optical pulses each having a pulse width of about $n\tau_f$, where τ_f represents a fluorescence lifetime of a laser dye and $3 \leq n \leq 25$;

directing said optical pump signal into an optical resonant cavity having a laser dye gain element that contains said laser dye for transforming said optical pump signal into an excited optical signal;

resonating said excited optical signal in said optical resonant cavity; and

emitting a portion of said excited optical signal from said optical resonant cavity.

8. The method of claim 7 wherein said optical pump signal has a pulse period in the range of about 1 Khz to 1 Mhz.

9. The method of claim 7 wherein said laser dye gain element includes a host material selected from the group that includes porous glass, plastic, and sol-gels.

10. The method of claim 9 wherein said plastic consists essentially of modified polymethyl methacrylate.

11. The method of claim 7 wherein said optical resonant cavity is a nearly hemispherical resonator.

13. A method for generating a laser output signal, comprising the steps of:
operating a laser diode system in a non-steady-state mode by generating an optical pump signal that is a sequence of optical pulses each having a pulse width *t*, wherein
$0.950 \leq 1-e^{-t/\tau_f} \leq 0.993$, and τ_f represents a fluorescence lifetime of a laser dye;

directing said optical pump signal into an optical resonant cavity having a laser dye gain element which contains said laser dye that is characterized by said fluorescent lifetime, τ_f, for transforming said optical pump signal into an excited optical signal;

resonating said excited optical signal in said optical resonant cavity; and

emitting a portion of said excited optical signal from said optical resonant cavity.

EVIDENCE APPENDIX

None.

RELATED PROCEEDINGS APPENDIX

None